Game-Based e-Tourism-e-Health Using SQL

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Abstract. AR games such as Pokemon Go, Jurassic World Alive and other games encourage us to venture out in the real open world to also see the beauty of it. However, tourism has come almost to a virtual stop during the first year of the COVID-19 pandemic and recovery is slow. We present a tile-based experience-sharing *PixoMap*, which incorporates some aspects of smart tourism. For user requirements gathering, we first compare factors that make popular games such as Pokemon Go, Minecraft, and the Sims popular. Findings indicate that people enjoy collecting objects, such as monsters or cards, freedom and creativity, escape and sometimes nostalgia. Our *PixoMap* game allows players to virtually browse an area in the map, and choose a tile. Each tile contains memories (*Memors*)/experiences/stories. Users can read others' experiences and share their own experiences, play a minigame to earn in-game currency, to change his/her 2D avatar or change the tile's color or optionally, to own the tile. Alpha user feedback confirms and refines our design. Heuristic evaluation and user experience feedback at the end of the study, are positive and encouraging.

Keywords: e-Tourism · e-Health · SQL · Minigames

1 Introduction

In 2020 and for 2–3 years to come, tourism is put into a tight spot due to the pandemic. Malaysian tourism did not escape the drastic drop in revenues (Fig. 1).

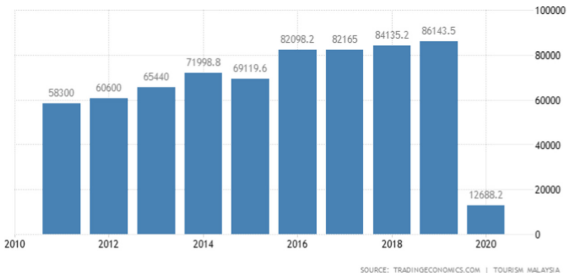

Fig. 1. Malaysian tourism revenues

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We would like to propose smart tourism-cum-e-health, using games. The benefits in playing games are known: education, cognitive stimulation, and enjoyment. Edmonds and Smith (2017) find that games can be beneficial to learning online, enhanced by location-based learning, mobile learning, digital storytelling and gamification. Wang and Hsieh (2018) add that games provide a means to work towards, and achieve dreams virtually. Moreover, games can provide a channel for players to escape reality, de-stress, and to learn (Cairns et. al., 2019).

Balakrishnan and Griffiths (2018) also find that a challenging game contributes most to a game being addictive, followed by "friends and family," then "entertainment". However, an increase in challenge leads to an increase in cognitive load. This will affect the enjoyment of the game. Hence, is challenge suitable for all ages? If challenge is more difficult for those who do not play games or play less games, then can cognitive training help reduce cognitive load?

Toril et al. (2014) find that older adults who participate in cognitive training via video games evidence positive effects. However, Sala et. al.'s(2018) meta-analysis study questions these benefits, as findings from other literature, indicate that cognitive training improves performance, only if the tasks are pre-trained. Furthermore, there is a lack of evidence in skill generalization across domains (far transfer). Hence, they investigate the psychology of expertise (what makes a person an expert), and a series of reviews on meta-analytic studies, via three random-effect meta-analytic models.

The first meta-analysis investigates the degree of correlation between video game skill and cognitive ability; the second, differences in video game players and nonplayers' cognitive ability; and the third, the effects of video game training on participants' cognitive ability. They find small or no overall effect sizes in all three studies. The more positive finding, is a weak correlation between overall cognitive ability and video game skill. Hence, they suggest that playing video games and enhanced cognitive ability are not causally related, and that video game training does not enhance cognitive ability.

Bediou et. al.'s (2018) meta-analysis on the effects of action video games on perceptual, attentional, and cognitive skills, shed further light. They first formulate cognitive profiles from the habitual actions of video game players via cross-sectional studies. Findings indicate a positive average effect of approximately, half a standard deviation ($g = 0.55$). Subsequently, they utilize long-term intervention studies, to investigate the potential of causally introducing changes in cognition by playing action video games. Findings are even more promising, with a smaller average effect of $g = 0.34$. Findings further reveal that action video game play greatly increases top-down attention and spatial cognition – promising for perception studies. Hence, they find that not all video games are similar in its effect on cognition.

From the above, we surmise that by itself, any game remains a game, unless the player has the ability to recognize patterns and to derive inferences. Thus, for those who are not experts, there is a learning curve, and as with any learning process, cognitive ability usually increases, with scaffolding. In non-structured games for seniors (Lee & Hughes, 2019), improved performance is due to freedom of expression, and varied alternatives in problem-solving. Hence, for cognitive stimulation/training, we need to generate germane load first, to tradeoff intrinsic and extraneous cognitive loads. The assumption is that strategy games involve more modelling and alternatives, than speed games. This is

positive in terms of motivation and morale. In the past, Lee and Ling (2020) find that students benefit more on cognitive training via strategy games compared to speed games.

1.1 Problem

Due to the pandemic in 2020 and 2021, physically travelling from one destination to another is highly discouraged, due to the virus itself having an increased chance of spreading when there are crowds. There are efforts to develop software/systems, which allow users to take pictures of themselves at a virtual preferred location of interest. There are also efforts to bring tourism to zoom or Youtube or 360.

Lee and Wong (2017) have attempted to develop community engagement in Smart Cities. In this paper, we look towards digital games, because they are popular and because there are multiple benefits. We look towards digital games, because they are popular and because there are multiple benefits. Hence, the first problem is to find out what makes these games popular, in order to develop tourism games, which can help introduce/promote a place and sustain visits to the game/place. Soukup (2020) note that the players' physical locations can create a cognitive map that directs, and focuses movements within a geographical space. They regard *Pokemon Go* as such a cognitive map, which can simplify and focus movements in urban spaces. The question that arises is, how can we use this for smart tourism-e-health?

There were some dangers to playing Pokemon Go as reported in Wagner-Greene et al. (2017), in places with heavy traffic. Hence, we adapt the cognitive map, to tiles. We were inspired by Reddit's "pixel-art". An example would be from a sub-reddit called "r/place" (Fig. 2). It was popular 4 years ago, as an April Fools' experiment. Users were to choose a pixel (and color) in the canvas, and create their own collective Art. If a certain part of a map is fully filled up with the cumulative effort of the playerbase, players can opt to disrupt the artwork of the other players, by taking over and changing the tiles' color.



Fig. 2. The final product of "r/place"

Wang and Hsieh (2018) point out that a location can have a positive bond with the memories of the players. However, perceived crowding can damage the enjoyment of the game. The next research question is, how can we address perceived crowding?

1.2 Objectives

Our objectives are:

1) to allow players to virtually browse an area in a real-world map, and choose a tile. The tiles contain memories, experiences and stories, shared by those who came to the tile before the player. These memories are called *Memors*. Users can read others' experiences and share their own experiences, within that area via the menu panel. Each of the tiles also contain a specific minigame, which every player can play to earn in-game currency called "gold". Gold is used to claim ownership of the tiles and to change the player's 2D avatar. Owners of the tile are also allowed to choose from 14 colors, to color the tile they own on the map. Hence, the main gameplay is to conquer tiles in order to color and/or put in *Memors* within the chosen tile. This would incorporate the experiences of a player within a single tile. By representing the real-life location in a tile, the tile becomes a virtual communication/review/recommendation space for smart tourism. Augmented Reality (AR) is a possible future venture.
2) to avoid overcrowding as highlighted by Wang and Hsieh (2018), we implement SQL. MySQL is required in multiplayer games, such as World of Warcraft MMORPGs. For *Pixomap*, SQL is used to scan a player and tile, and data manipulation. Such player data includes the player's ID, name, amount of gold and etc., while the map tiles' data are the tile's ID, the owner of the tile, the *Memors* and etc.
3) to enable repurposing of this system for e-health as well, as the note-taking/sharing of experiences/playing the mini-games can reduce cognitive load, be a part of cognitive training, as well as de-stressing.

2 Related Work

2.1 Game Genre

To identify the relevant game genre, which would fit our objectives, we identify possible relevant examples within the following game genres: action games (shooters), simulation and builder games, MMORPGs and collecting games (card and monsters). These are presented in Table 1.

Table 1. Game genre

Action games (shooter)	Simulation and builder games	MMORPGs	Collecting games (card, monsters.)
Call of Duty: Modern Warfare	The Sims	World-of-Warcraft	Pokémon
Warframe	Spore	RuneScape	Jurassic World Alive
Counterstrike-Global Offensive	Zoo Tycoon	Ragnarök Online	Magic-The-Gathering
Halo: Combat Evolved	Minecraft	Elder Scrolls Online	Yu-Gi-Oh!

2.2 Factors Which Made Life Simulation and Collecting Games Popular

Subsequently, we compare factors, which contribute to the games' popularity (Table 2), and similarity among these factors (Table 3).

Table 2. Factors which contributed to their popularity

	Games			
	Game 1: Pokémon Go	Game 2: Yu-Gi-Oh!	Game 3: Minecraft	Game 4: The Sims
Factors which popularized them	Enjoyment in collecting monsters [16, 24, 25, 30]		Freedom of creativity and playing within the constraints of the game [17, 29]	
	Enjoyment in battling opponents with the Pokémon and taking over the gym or in Yu-Gi-Oh!, the cards [25]		Life simulation and escapism [15, 23]	
	Nostalgia/Word-of-Mouth/established brand	Potential investment - prices of some physical cards may skyrocket [30]	Ability to roleplay [15, 26, 27]	
	Recognition and Approval [28, 30]		Diverse gameplay [18]	

Table 3. Similarity in factors, which popularized the games

	Games				
Factors, which made them popular	Pokémon Go	Minecraft	The Sims	Yu-Gi-Oh!	*PixoMap*
Collecting	■			■	■
World-building and customizing /Simulation		■	■		■
Role-Play		■	■		
Battling	■	■		■	
Competitive	■			■	■
Exploration	■	■			■

2.3 Scope

There are multiple game genres, such as action games, simulation and builder games and etc. From the above literature reviewed, we choose object customization (the tiles),

collection (take over) and exploration of different places, which the players not have visited within that city/area.

3 Methodology

The incremental agile methodology is applied, with distributed processing in mind, due to *PixoMap*'s storytelling nature. As stated above, the main focus of the game is how players interact with each tile, and how they creatively utilize and manage them. With XAMPP in this project, it will also be a multiplayer game that is server-based. The SQL-side of the game will only handle the player and tile's data. The game's engine will be Unity, php. SQL operators applied are:

- The Arithmetic (e.g. +, *, | | for in-game currency calculations);
- Comparison (e.g. =, >, < to check whether the player has the conditions they are required fulfilled before performing an action or compare if the player's ID matches with a conquered tile, e.g. when purchasing an item);
- Logical Operators (e.g. NOT, AND, OR to determine whether the condition or values are true or false, e.g. whether the player is the tile's owner or if the tile is taken).

The UI design is via the *Clip Studio Paint* software, while some parts of the game that requires pixelated designs is via a free web-based tool *Piskel*. Users can hold left click and drag to pan or WASD to navigate. The middle mouse wheel is to zoom in/out.

The user requirements gathering/confirmation questionnaire is designed mainly based on *PixoMap's* proposed functional requirements, with Davis' (1989) Technology Acceptance Model in mind. Beta testing user survey results are based mainly on Davis' (1989) Technology Acceptance Model, supported by Nielsen's (1994/2000) heuristic evaluation questionnaire and Schrepp et. al.'s (2017) user experience questionnaire.

4 System Description

4.1 Game Genre

PixoMap is an ARG that uses tile-based elements and mechanics based on the real-world map. Players visit each tile, share their experiences/memory of the location of the tile, and unlock various rewards that they can use, e.g. to colour the chosen tiles. This can lead to artistic pieces, if the user(s) decides to capture the tiles surrounding it, and creatively colour them. Not only that, each tile would have a different minigame, where users can also play for more gold. Players can *optionally* take over the tile, and change the player's avatar.

4.2 Design

Use Case. The *PixoMap* use case diagram (Fig. 3), indicates the primary actor (the player), and tasks that he/she can carry out in *PixoMap*.

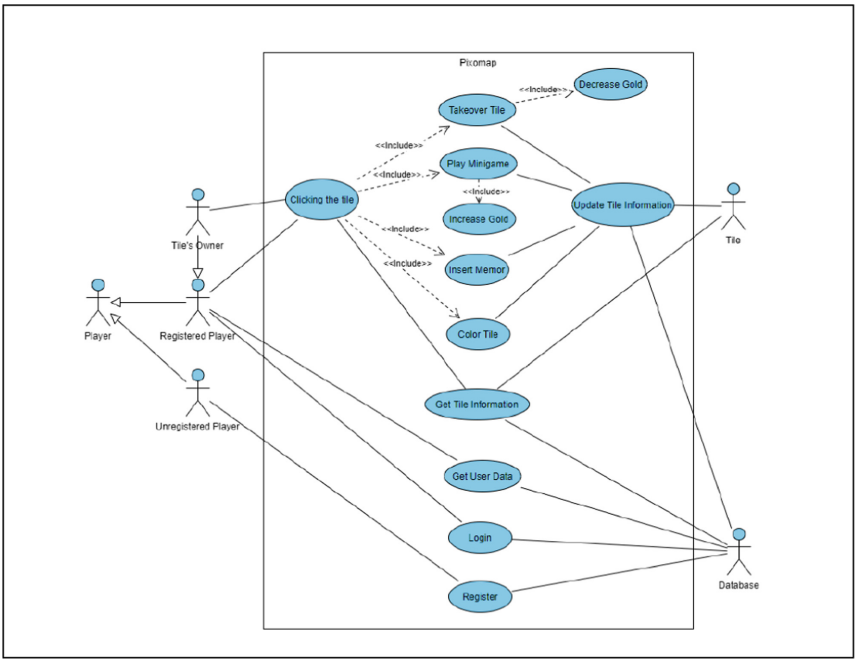
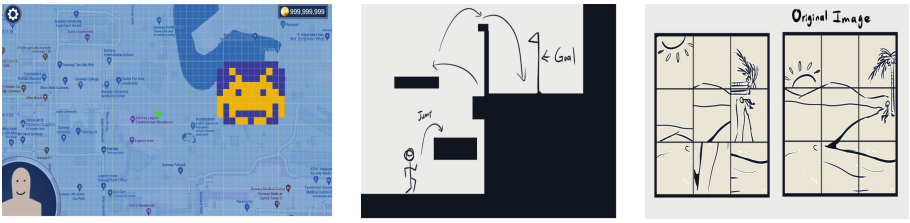


Fig. 3. *PixoMap's* use case diagram



(a) **(b)** **(c)**

Fig. 4. **a.** Proposed *PixoMap* UI, gameplay. **b, c.** Sample minigames

PixoMap UI and Gameplay. Figure 4a presents the proposed PixoMap UI and gameplay. Figures 4b, c present sample minigames. Minigames would be from the Internet since this is just a capstone project and there is a time constraint.

4.3 User Requirements Gathering/confirmation and Refinement of System Design/functional Requirements

To confirm the functional requirements derived from related work, and our own hypotheses and ideas, we carried out a user survey. The survey covered 2 sections: demographics, and perception towards the design of the main gameplay, perception towards the design of *Memors*, perception towards the potential of *PixoMap*, as a means to express their own creativity and perception towards the design of the minigames.

Participants' Age Group and Their Experiences with Video Games. Most of the participants (83.3%) are aged between 19–23, and 16.7% are slightly older, i.e., 24–55 years of age (Fig. 5). Majority of the players have played video games for many years, i.e., 5–9 years (30%), and 10 years and above (36.7%) (Fig. 5b).

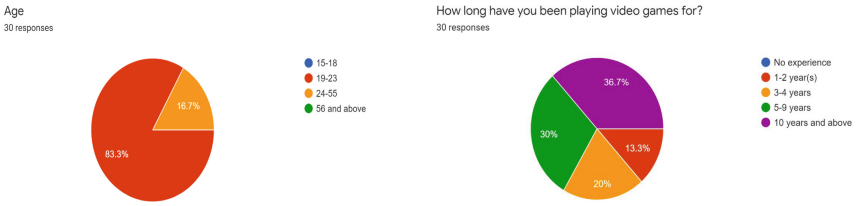


Fig. 5. **a.** Participants' age. **b.** Participants' gaming experience

Gameplay. From the alpha user feedback, we find that perception towards *PixoMap* is mixed, but more inclined towards positive, for players mainly within the 19–23 age bracket. Most of them (36.7%) have more than 10 and 30% 5–9 years of experience playing games. Hence, expectations are higher. Furthermore, this majority prefer competitive games and taking over objects (Figs. 6a, b). Between collecting items and in-game currency, 90% of the respondents prefer the former (Figs. 6c, d). To discourage tile ownership, we increase the amount of gold required to 600 gold, instead of 40, and increase the merit of playing a minigame to 200 gold, instead of 20.

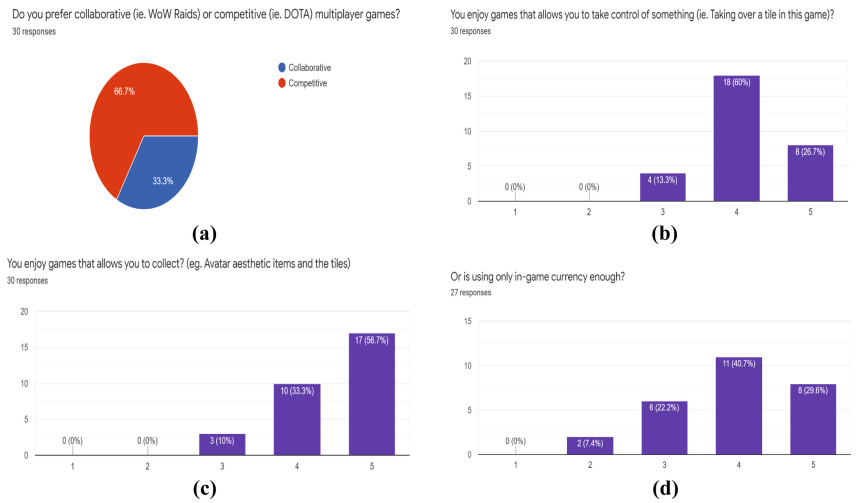


Fig. 6. **a.** Should it be collaborative/competitive? **b.** Is object conquering enjoyable? **c.** Are games with collectibles fun? **d.** Is in-game currency fun enough?

Memors. Majority (86.6%, 99.3%) of the respondents think that *PixoMap* and *Memors* can help smart tourism by attracting players to the location of the tile (Figs. 7a, b, c). Hence, a 2-grid system, where one is used to interact with the grid, while the other is to display the colours of the tiles, is implemented. However, 63.3% are not sure whether to share *Memors* publicly (Figs. 7d, e), but 93.3% agree that *PixoMap* will help them remember past memory of the particular tile/location. Thus, a player can insert only one *Memor* in a tile, either publicly or privately.

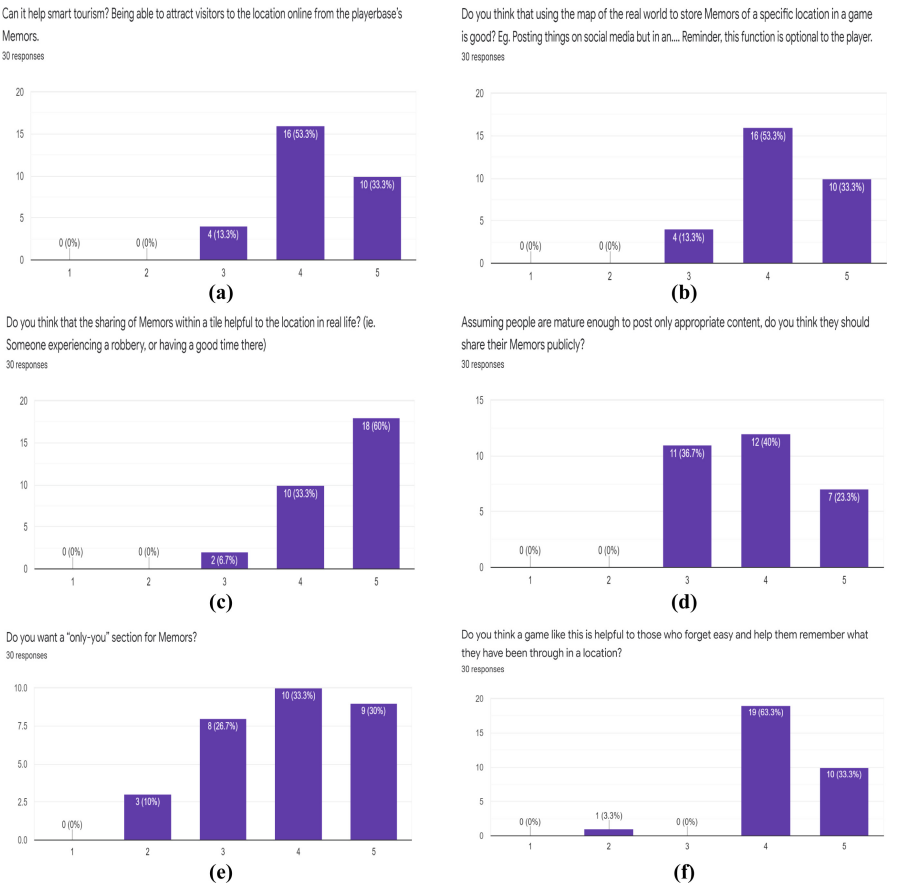
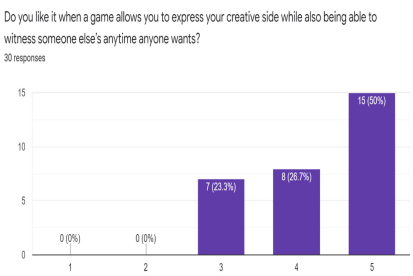
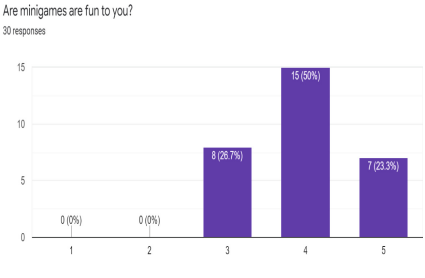


Fig. 7. **a**. Are there benefits to Smart Tourism? **b.** Are *Memors* of a location beneficial? **c.** Will *Memors* also be useful for future visitors? **d.** Should people share their *Memors* publicly? **e.** Would users prefer an "Only-You" function? **f.** Is *PixoMap* beneficial to memory?

Creativity and Minigames. As for creativity, 76.7% are positive about possibilities for creative expression (Fig. 8a). Furthermore, 73.3% think that minigames are fun (Fig. 8b). The respondents are also split about whether the minigame should be random (46.7%) or specific to a tile (53.3%) (Fig. 8c). Hence, we infer that some respondents play to win, whereas some, play for fun and look forward to a preferred minigame. Moreover, 83.3% think that avatars should be developed, only if they are customizable (Figs. 8d, e), as part of identity.



(a)



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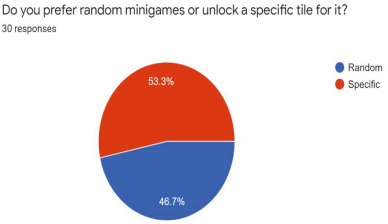

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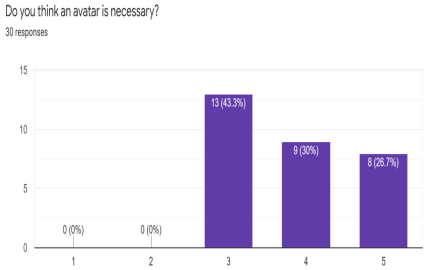

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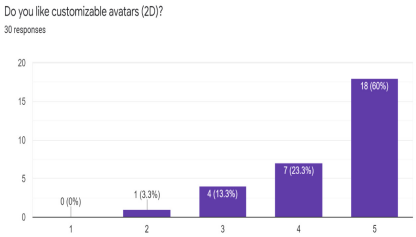

(e)

Fig. 8. **a.** Sharing creativity of players **b.** Are minigames fun? **c**. Should minigames be tile-specific or random? **d**. Demand for an avatar **e**. Customizable 2D avatars

5 Development

Based on the above user requirements gathering/confirmation of our proposed design, the camera views, a 2-grid system is introduced, and the point system, and number of *Memors* per person per tile are revised. The final prototype is presented in Figs. 9a–d below.

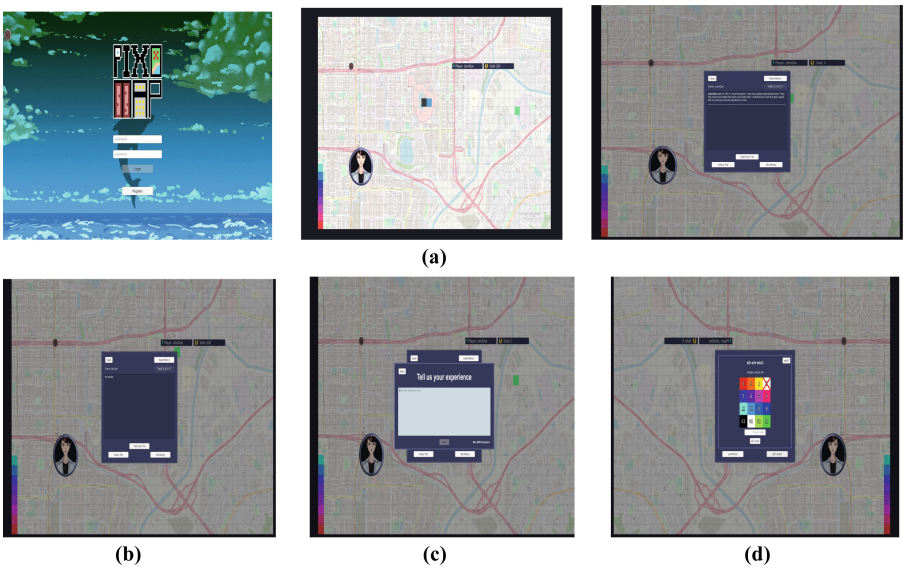

Fig. 9. **a.** Main game scene. **b.** Opening *Memor* (getting tile's coordinates, owner and *Memor*). **c**. Inserting *Memor*. **d.** Colouring the tile

6 Beta Testing Evaluation Findings and Discussion

In this survey, we evaluate the game's heuristic quality and user experience (UEQ). This survey involves only 5 expert testers/gamers who can spare their time and are very capable in pointing out any issues with the game, that might not be too obvious. Since they are experts, Nielsen's (1994; 2000) heuristic evaluation is used. The averages for each question are presented in Table 4. User experience questionnaire results are presented in Table 5. Further breakdown of the UEQ are presented in Figs. 10a–d.

We find that players are mostly positive about *PixoMap*. They find it clear and easy to use (ease of use in TAM, easy in UEQ), inventive (100%) and moderately leading edge (60%). These reflect system quality in TAM. Other promising aspects are the liveliness/action progression of each tile, it being an ARG, with actual relation to the real world, and challenging (take-over) games. These contribute to the interesting factor in the UEQ. As such, 60% would recommend *PixoMap* to their friends. Comments gathered indicate requests for more minigames, and more multi-tile selection. We conjecture, the authenticity of the in-currency game may also be a key motivator, similar to Shoppee's.

Table 4. Heuristic evaluation results

No.	Construct	Avg.
1	Match between system and the real-world	0.84
2	Consistency and standards	0.84
3	Recognition and efficiency of use	0.84
4	Visibility of system status	0.80
5	User control and freedom	0.80
6	Flexibility and efficiency of use	0.76
7	Aesthetic and minimalist design	0.76
8	Help users recognize, diagnose, recover from errors	0.76
9	Help and documentation	0.72
10	Error prevention	0.64

Table 5. UEQ results

No.	Construct	Avg.
1	Complicated/easy	0.88
2	Conventional/inventive	0.88
3	Not interesting/interesting	0.84
4	Obstructive/supportive	0.80
5	Inefficient/efficient	0.80
6	Confusing/clear	0.76
7	Usual/leading edge	0.76
8	Boring/exciting	0.68

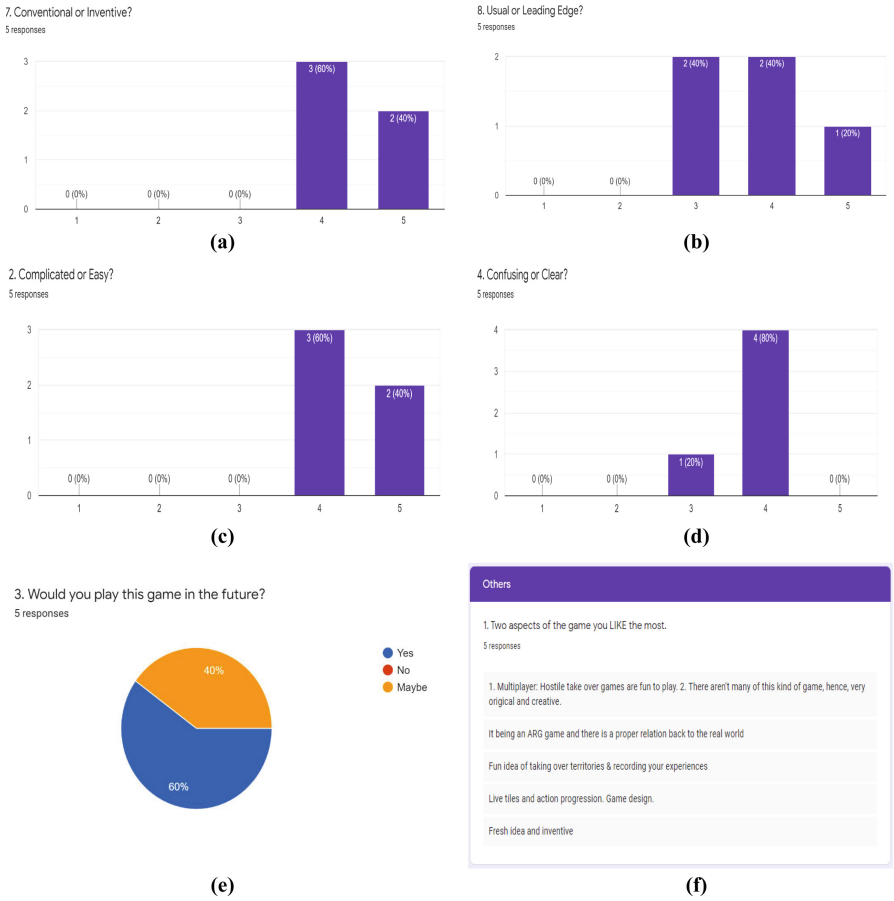

Fig. 10. **a.** Users find *PixoMap* inventive. **b.** Users find *PixoMap* moderately leading edge. **c.** Users find *PixoMap* easy. **d.** Users find *PixoMap* sufficiently clear. **e.** Possibilty of returning to *PixoMap*/playing in the future. **f.** What players like about *PixoMap*

7 Conclusion

The literature review has highlighted the significance of memorability, collectibles, freedom and creativity, escape and sometimes nostalgia in games. *PixoMap* can be used for e-tourism and e-health. Since it can be made public/private, it can serve as a notebook of memories and experiences of different places of visits and interest (private). Reading of others' experiences other than reviews available at other websites, and earning authentic in-game currency, to being a part of a larger community of gamers or artists, can help sustain interest. Incorporating SQL has prevented perceived sense of over-crowding. With the tile as thumbnail, it may enable users/players to link to the places of interests, receive recommendations, and collect specific rewards as well. We hope that *PixoMap* will lead to more cross-SDG platforms, lean in design, but beneficial to diverse stakeholders. We also acknowledge that images may serve better than text in the sharing of experiences.

Acknowledgement. The paper is extended from a Sunway University capstone project, titled *Fun Games using SQL*, meant mainly for smart tourism. The first author is currently working in the industry. Additional elaboration and additional analyses/links to e-health, cognitive load, Reddit and e-commerce research by the second author, indicate the potential of repurposing systems, across SDGs and possibly, the metaverse in the future; continuing from and funded by the second author's past Fulbright Visiting Scholar Fellowship on *A Framework for Interactive Media in Emerging Technologies.*

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